

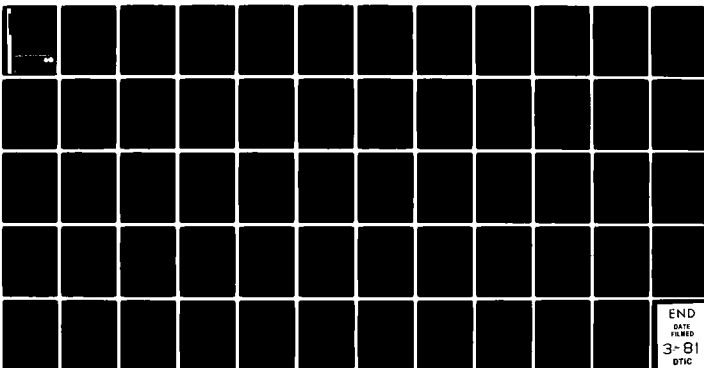
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**DEFLAGRATION-TO-DETONATION TRANSITION
IN HETEROGENEOUS SOLIDS: A BIBLIOGRAPHY**

By
E. W. Price

Prepared for
OFFICE OF NAVAL RESEARCH
ARLINGTON, VIRGINIA 22217

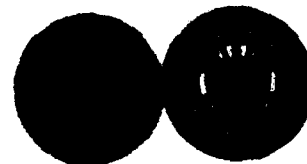
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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) | | |
| <p>This publication contains a list of 341 references relating to the mechanism of transition to detonation in heterogeneous high energy solids, with particular reference to solid rocket propellants and granular propellant charges for guns. Because of the important role played by porosity, many of the references pertain to flow, flame spread and pressure rise in porous materials, and to the mechanics of formation cracks and propagation under dynamic loading.</p> <p>(continued on reverse side)</p> | | |

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20. ABSTRACT (continued)

This partial list of references was developed primarily from lists contained in papers presented at the 1978 ONR/AFOSR Workshop on Deflagration-to-Detonation Transition (CPIA Publication 299, September 1978), and from reports received subsequent to that Workshop. A subject coding was developed and used to classify each reference.



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INTRODUCTION

This partial bibliography was assembled in connection with the organization and reporting of the ONR/AFOSR Workshop on Deflagration-to-Detonation Transition (see page 8). The bibliography was compiled from the reference lists of the papers of that Workshop and of reports received subsequently. Entries are listed in alphabetical order of the first author. The papers presented at the Workshop are listed separately on pages 8 to 10, reproduced from the Table of Contents of the proceedings of the Workshop (Chemical Propulsion Agency Publication 299, September 1978).

An effort was made to subject code the papers in the bibliography, to aid the reader in locating references of specific interest. The subject coding is described on page 6. This coding was developed informally for the present purposes, and is not proposed for any other purpose. Since 65% of the references were available only as titles, subject coding was sometimes only a little better than key-word sorting to the present context. If the subject coding is used, the user should be aware of the following conditional features.

1. Collection of references was not exhaustive; the bibliography may help, but is not complete.
2. Collection and choice of titles from the original source lists was selective in that only papers helpful to investigators of DDT were included.
3. Subject coding is not necessarily based on full knowledge of papers.

The subject coded bibliography may be used effectively to guide entry into the relevant DDT literature, assure reasonable perspective, and identify a large portion of scientists active in the field.

SUBJECT CODING

The bibliographical entries were examined and subject content judged on the basis of title and prior knowledge of the project or investigator (in the case of about 35% of the entries, the papers had been heard or read). A subject coding was designed on the basis of discussions with several active investigators, and further evolved as a result of preliminary attempts to fit it to the bibliography. The resulting coding is shown below. Each paper is marked with one or more subject code numbers. Ten general subject categories were chosen, and subcategories identified as needed in each. In the numerical coding, the entry to the left of the decimal indicates the general category, and the number to the right is the subcategory. If no subcategory is assigned, it may be because insufficient information was available; alternately, it may be because all subcategories are relevant.

1. Mechanics of Solids
 - 1.1 Equation of state
 - 1.2 Material properties
 - 1.3 Crack initiation
 - 1.4 Crack propagation
 - 1.5 Role of microscopic heterogeneity
2. Combustion
 - 2.1 Diffusion controlled
 - 2.2 Combustion in cracks
 - 2.3 Convective burning (porous material)
 - 2.4 Heat transfer (in cracks, pores, transient)
 - 2.5 Ignition
 - 2.6 Stability of "normal" burning
 - 2.7 Burning rate

3. Detonation
 - 3.1 Waves (velocity, structure)
 - 3.2 Thermodynamics
 - 3.3 Equation of state
 - 3.4 Shock initiation, detonation thresholds
 - 3.5 Limits to sustain detonation
 - 3.6 Confinement
 - 3.7 Sustaining reactions
4. Transition
 - 4.1 Pressure rise in combustion wave
 - 4.2 Wave reflection
 - 4.3 Instability of normal burning
 - 4.4 Confinement
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5. Porous Granular Media
 - 5.1 Characterization
 - 5.2 Flow through
 - 5.3 Motion, compaction
 - 5.4 Heat transfer
 - 5.5 Pressure wave propagation in
 - 5.6 Flame propagation in
6. Gun Interior Ballistics
 - 6.1 Equation of state at high pressure
 - 6.2 High pressure burning rate
 - 6.3 Spread of ignition
 - 6.4 Waves
 - 6.5 Combined processes, chamber constraints
7. Chemistry
8. Experimental Methods
9. Computational Methods
10. Review

PRESENTATIONS AT DDT WORKSHOP

REPRODUCED FROM CPIA PUBLICATION 299, SEPTEMBER 1978.

Foreword

INTRODUCTORY PRESENTATIONS

INTRODUCTORY COMMENTS ON TRANSITION FROM DEFLAGRATION
TO DETONATION

E. W. Price, Georgia Institute of Technology, Atlanta,
Georgia

THE INADVERTENT DETONATION OF LARGE SOLID MOTORS LOADED WITH
HIGH ENERGY PROPELLANTS

J. F. Kincaid, The Johns Hopkins University, Applied
Physics Laboratory, Laurel, Maryland

MECHANICAL DEFORMATION AND FAILURE UNDER DYNAMIC LOADING

DYNAMIC FAILURE IN HETEROGENEOUS SOLIDS

J. D. Achenbach, The Technological Institute, North-
western University, Evanston, Illinois

MECHANICAL BEHAVIOR OF SOLID PROPELLANT

R. A. Schapery, Texas A&M University, College Station,
Texas

MECHANISMS OF FRACTURE INITIATION AND GROWTH IN ELASTOMERS

A. N. Gent, Institute of Polymer Science, The
University of Akron, Akron, Ohio

CRACK PROPAGATION IN SOLID PROPELLANTS

S. R. Swanson, University of Utah, Department of
Mechanical and Industrial Engineering, Salt Lake
City, Utah

NUMERICAL CAPABILITIES IN FRACTURE MECHANICS

E. B. Becker, Professor of Engineering Mechanics,
University of Texas, Austin, Texas

EXPERIMENTS ON CRITICAL STRESS INTENSITY FACTORS RESULTING
FROM STRESS WAVE LOADING

W. G. Knauss, California Institute of Technology,
Pasadena, California and G. C. Smith, Oak Ridge
National Laboratory, Oak Ridge, Tennessee

STEADY AND TRANSIENT COMBUSTION

SELF DEFLAGRATION OF HETEROGENEOUS SOLIDS

E. W. Price, Georgia Institute of Technology,
Atlanta, Georgia

PROPELLANT BURNING RATES

T. L. Boggs, Naval Weapons Center, China Lake,
California

THE BURNING RATES OF DAMAGED HIGH ENERGY SOLID PROPELLANTS

T. L. Boggs, D. E. Zurn, A. H. Lepie and R. L. Derr,
Naval Weapons Center, China Lake, California

CONVECTIVE BURNING IN SOLID-PROPELLANT CRACKS

K. K. Kuo, Mechanical Engineering Department,
The Pennsylvania State University, University Park,
Pennsylvania

ONSET AND DEVELOPMENT OF CONVECTIVE COMBUSTION

H. H. Bradley, Jr. and T. L. Boggs, Aerothermochemistry
Division, Naval Weapons Center, China Lake, California

ANALYSIS OF BURNING IN GAS PERMEABLE REACTIVE BEDS

P. S. Gough, Paul Gough Associates, Inc., Portsmouth,
New Hampshire

CRITERIA FOR IGNITION OF SOLID PROPELLANTS

R. L. Derr, Naval Weapons Center, China Lake,
California

MODELING THE DDT PROCESS

D. T. Pilcher, Hercules Incorporated, Bacchus Works,
Magna, Utah

A SYNOPSIS OF MATHEMATICAL MODELING TO STUDY DDT IN GRANULATED ENERGETIC SOLIDS

H. Krier, Department of Aeronautical and Astronautical
Engineering, University of Illinois at Urbana-Champaign

PRESSURE RISE AND SHOCK FORMATION

INTRODUCTION TO THE PANEL ON TRANSITION TO DETONATION

J. Hershkowitz, Applied Sciences Division, LCWSL,
ARRADCOM, Dover, New Jersey

DDT OF SECONDARY EXPLOSIVES AND PROPELLANTS

P. A. Urtiew, Lawrence Livermore Laboratory, Livermore,
California

**EXPERIMENTAL TECHNIQUES AND RESULTS FOR PROPELLANTS AND
EXPLOSIVES**

R. R. Bernecker, Naval Surface Weapons Center, White
Oak Laboratory, Silver Spring, Maryland

SHOCK WAVE FORMATION DURING ACCELERATED DEFLAGRATION

D. E. Kooker, US Army Ballistic Research Laboratory,
Aberdeen Proving Ground, Maryland

SHOCK INITIATION OF EXPLOSIVES

C. A. Forest, Los Alamos Scientific Laboratory,
Los Alamos, New Mexico

STEADY STATES AND TRANSITIONS IN ENERGETIC MEDIA

J. Hershkowitz, Applied Sciences Division, LCWSL,
ARRADCOM, Dover, New Jersey

APPENDIX

Meeting Attendees
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